The Pu(IV) Polymer Story: From Discovery to Current Knowledge

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The formation of Pu(IV) colloids may greatly influence the source term for actinide transport when compared to dissolved ionic plutonium species. Environmental waters in contact with plutonium can contain intrinsic (the attributes real, pure, true or eigen are also used) colloids in addition to pseudo-colloids. Intrinsic colloids are formed when actinides are present in concentrations exceeding the solubility product. Actinides in low-pH-hydrolysis-sensitive oxidation states (IV and VI) can form real colloids by condensation and polymerization reactions forming polymers in the size range between micro- and nanometers. Larger colloids tend to agglomerate and precipitate, whereas smaller ones remain dispersed in solution. Pu(IV) colloids have been studied extensively. This talk will present an overview of Pu(IV) colloid research from the Manhattan Project until today. Several examples of Pu(IV) polymer formation in plutonium solubility studies related to both low-ionic strength and to highly saline model waters will be discussed. This talk will demonstrate how well our understanding of Pu(IV) colloid formation and stability has improved during the last decade.

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